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EFFECTIVE PROSE READING--SHAPING AND DISCRIMINATIVE EFFECTS OF QUESTIONS.

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THE CONCLUSIONS OF AN EARLIER STUDY LED TO THIS STUDY OF THE EFFECTS OF QUESTIONS INTERSPERSED IN THE READING MATERIAL, OF QUESTIONS PRESENTED AFTER THE MATERIAL, AND OF THE MODE OF QUESTIONING ON LEARNING FROM PROSE. ABOUT 120 PSYCHOLOGY STUDENTS READ TWENTY 10-SENTENCE PARAGRAPHS OF BIOGRAPHICAL NATURE WITH EITHER A QUESTION BEFORE EACH PARAGRAPH, TWO OR MORE QUESTIONS AFTER TWO OR MORE PARAGRAPHS, OR WITH QUESTIONS APPROPRIATELY INTERSPERSED IN THE WHOLE MATERIAL. NO KNOWLEDGE OF THE RESULTS WAS GIVEN AFTER THE QUESTIONS, AND THE STUDENTS WERE NOT ALLOWED TO REVIEW THE PARAGRAPHS. THE POST-TEST WAS A MULTIPLE-CHOICE TEST CONSISTING OF THE 20 QUESTIONS FOUND IN THE MATERIAL READ AND OF 20 NEW QUESTIONS TO TEST INCIDENTAL LEARNING. RESULTS SUPPORT EARLIER FINDINGS THAT POST-QUESTIONING PRODUCES HIGHER LEARNING, PARTICULARLY WHEN THE PACING OF QUESTIONS IS INCREASED. THE HIGHER THE PACING OF QUESTIONS, THE LARGER THE DISCRIMINATION BETWEEN RELEVANT AND INCIDENTAL RECALL. TOO MUCH EXPOSURE TO THE QUESTIONS DECREASED INCIDENTAL RECALL. REGARDLESS OF PACING OR THE LOCATION OF QUESTIONS, HIGHER INCIDENTAL RECALL WAS OBTAINED WHEN THE INCIDENTAL TEXT MATERIAL FOLLOWED THE RELEVANT TEXT MATERIAL. THE MODE OF QUESTIONING DID NOT INFLUENCE LEARNING. A GRAPHIC REPRESENTATION OF FINDINGS IS INCLUDED. THIS PAPER WAS PRESENTED AT THE AMERICAN EDUCATIONAL RESEARCH ASSOCIATION CONFERENCE (CHICAGO, FEBRUARY 6-10, 1968). (NS)

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Effective Prose Reading: Shaping and Discriminative Effects of Questions[1]

by

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I'm sure we are all aware of various efforts to apply psychological techniques and theories to education. Certain principles from the learning laboratory, most notably operant conditioning principles, have been extended into education in the form of programmed instruction. Although there may be disagreement about whether these principles are actually represented in such learning programs, it seems clear that the beginnings of a general technology of instruction are evolving out of the research which such materials have stimulated.

But there has come about a certain research dilemma concerning programmed instruction. It has been found that learning can take place efficiently without the program format. For instance, college students can learn equally well in less time from ordinary prose or mere summaries than they do with the programmed material covering the same information.

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[1] Paper read at the Annual Convention of the AERA - Chicago, 1968.

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So part of the current instructional theory and research is beginning to concern itself with the development of principles and techniques which relate especially to the mature student who probably does not need to be led step by step through a certain content area. The focus of this aspect of instructional technology concerns itself with the stimulus controls for general problem solving responses which students already possess (mathemagenic behaviors, as Rothkopf has called them). The emphasis here is not upon the development of particular skills, but upon the ways in which available skills might be elicited in the presence of printed materials which themselves are not programmed.

Elaboration of the technology relevant to the mature learner has important practical, as well as theoretical, implications. Through the use of questions or various other cues, it might be possible to program learning from currently available text materials.

Problem

This study was an attempt to extend the results of earlier work which showed that learning from prose materials can be improved if questions are included <u>after</u> seqments of the material. Such improvement does not occur if the questions are placed <u>before</u> those segments. There were some hints in the earlier research which indicated that a necessary condition for this facilitation might be that

the post-questions need to occur fairly often in conjunction with the material to which they relate. That is, if 10 post-questions are interspersed in the material, facilitation will occur. If all 10 questions are given after the reading, facilitation will not occur. The earlier research also suggested that increased pacing of pre-questions might actually lead to depressed performance.

Method and Results

I won't burden you with a lengthy description of the study. The design is indicated on the first page of the Appendix. Briefly, the subjects (Ss) read a 2000 word biographical passage. Some of the Ss saw a question before each 10 sentence paragraph, some saw two questions after two 10 sentence paragraphs, etc. Other Ss saw these questions, appropriately spaced, after the paragraphs. No knowledge of results was given after the questions, and Ss were not allowed to review the paragraphs once they had turned over the page. All questions and all paragraphs were on separate sheets of paper. After reading all 20 paragraphs and questions, Ss immediately completed a 40 item multiple-choice test which included the 20 questions they had seen with the text and 20 other questions which they had not seen (the latter were used to test incidental learning). For half of the Ss the questions in the text were multiple-choice, for the other half the questions were constructed response items.

Figure 1 (in the Appendix) indicates some of the results. It is clear, for instance, that questions after the paragraphs produced higher learning than questions before ($p < .001$). This replicates the results of the earlier studies. Figure 1 also indicates that there was an interaction between the pacing and position of the questions ($p < .05$). As the pacing of the questions increased the post-question groups did better, the pre-question groups did worse.

There was no interaction between question position, pacing, and the retention of relevant or incidental content; hence, the pacing effect was not due to any focussing upon the relevant material mainly by the groups which saw the questions before the paragraphs.

Figure 2 shows the focussing effect, which occurred across all groups. The higher the pacing of the questions the larger the discrimination between relevant and incidental recall ($p < .05$). It is interesting to note that frequent exposure to the questions did not produce a sharp rise in recall of the relevant material, but rather a sharp relative decrease in recall of the incidental material. There was, of course, an overall higher level of recall for the relevant material than for the incidental ($p < .001$).

I will mention two other results in passing. First, as can be seen in Figure 3, regardless of pacing or location of the questions, higher incidental recall was obtained when

the incidental text material followed the relevant text material (interaction $p < .025$). I'm not sure what to make of this finding. Evidently, very close proximity of the question and question related material is not a critical condition, and Ss are more likely to skip over material to get to something relevant than they are to skip over material in a paragraph after they have read something relevant to a question.

Finally, the mode of questioning (multiple-choice or constructed response) did not influence learning.

Conclusion

It may very well be true, as some authors have claimed, that mature readers can learn as much from prose as from programmed materials. But, as we have seen, it is also possible to improve learning from prose materials by using fairly simple stimulus controls - such as questions. Programming learning from prose materials then, requires a slight modification of technique. There are analogies between the pacing condition in the present study, and the step-size variable in conventional programs, and between the position of questions and prompting and confirmation as used in programming, which bear closer analysis. The fact that learning from gross instructional materials can be manipulated in a predictable manner suggests that the technology of instruction will soon include an understanding and application of relatively flexible methods of control.

The present results have some practical implications. Reflecting upon current textbook practice reveals that most authors tend to place questions at the end of chapters. In terms of the present study this is not an optimal strategy. Or rather, it doesn't make much difference where you put the questions in relation to the relevant content unless the questions are interspersed in the text immediately after relatively small chunks of material.

As an adjunct to current texts these questions might be indicated by numbers in the margins of the text, the numbers referring to the adjunct questions which are physically separate from the book itself. The teacher or publisher could modify these questions very easily.

At any rate, there are practical, as well as theoretical implications of the present research, which I think make an interesting but relatively unexplored topic.

APPENDIX

Subjects

128 introductory psychology students.

Design

2x4x2x2x2 analysis of variance with repeated measures on the last factor.

Factor

1. Question location (before or after paragraphs) -2 levels
2. Question pacing (1 question after every 10 sentences, 2 questions after every 20 sentences, 4 questions after every 40 sentences, or 5 questions after every 50 sentences)-4 levels.
3. Content location (question-relevant content located in the 1st or 2nd part of each 10 sentence paragraph)-2 levels.
4. Question mode (multiple-choice or constructed response)-2 levels.
5. Posttest items (covering prose content which was relevant or incidental to the questions which Ss viewed along with the text material) -2 levels.

Prose Material

2000 word passage about William James.

Test Questions

Same factual knowledge questions used on posttest as in text. Relevant and incidental questions were of equal difficulty. An S would thus see questions 1, 3, 5, etc., while reading the text, but his posttest would include items 1, 2, 3, 4, 5, 6, etc. Items 2, 4, 6 would thus test his incidental learning. Relevant and incidental subsets were counterbalanced across groups.

Constructed response items were created by dropping the alternative from the multiple-choice items and inserting a blank in the stem of the question.

Procedure

Subjects were allowed to read the prose at their own pace. Questions were interspersed in the prose according to experimental conditions. No knowledge of results were given after the question. Subjects were not allowed to turn back once they had finished reading a page of text. After reading, S went on to the 40 item posttest.

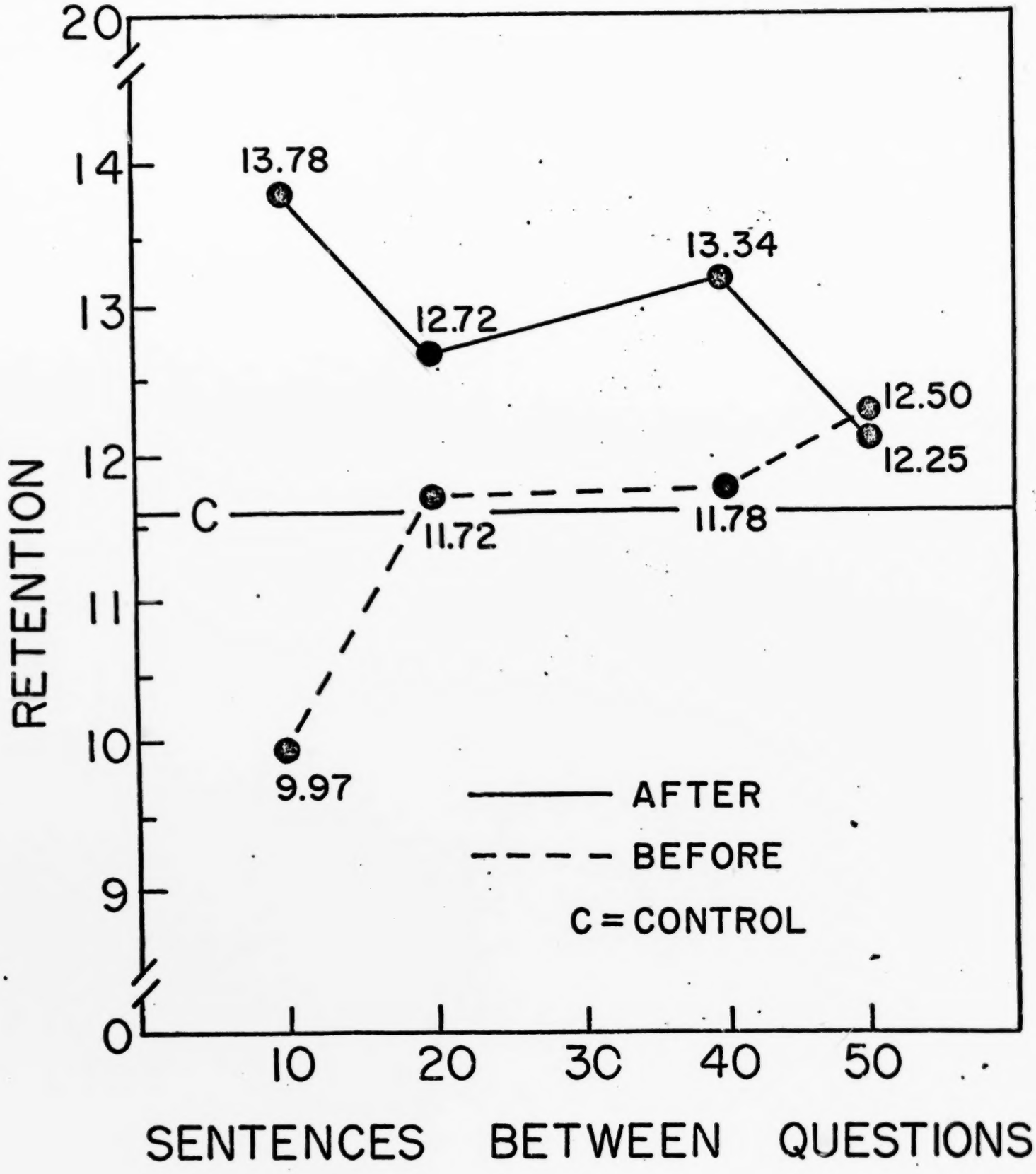

Fig. 1. Retention as a function of question position and pacing. C=average of all conditions.

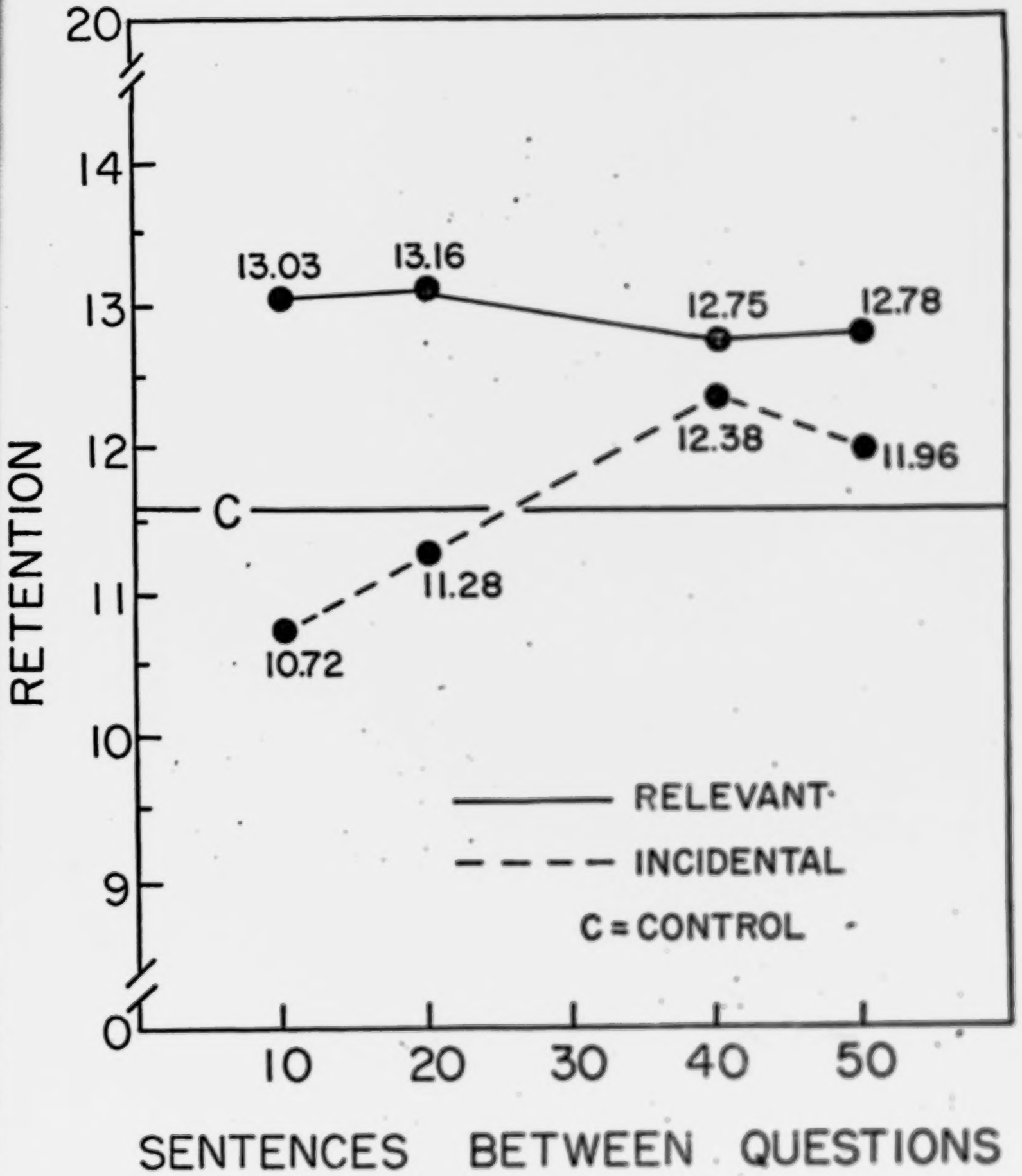

Fig. 2. Retention as a function of retention item and pacing. C=average of all conditions.

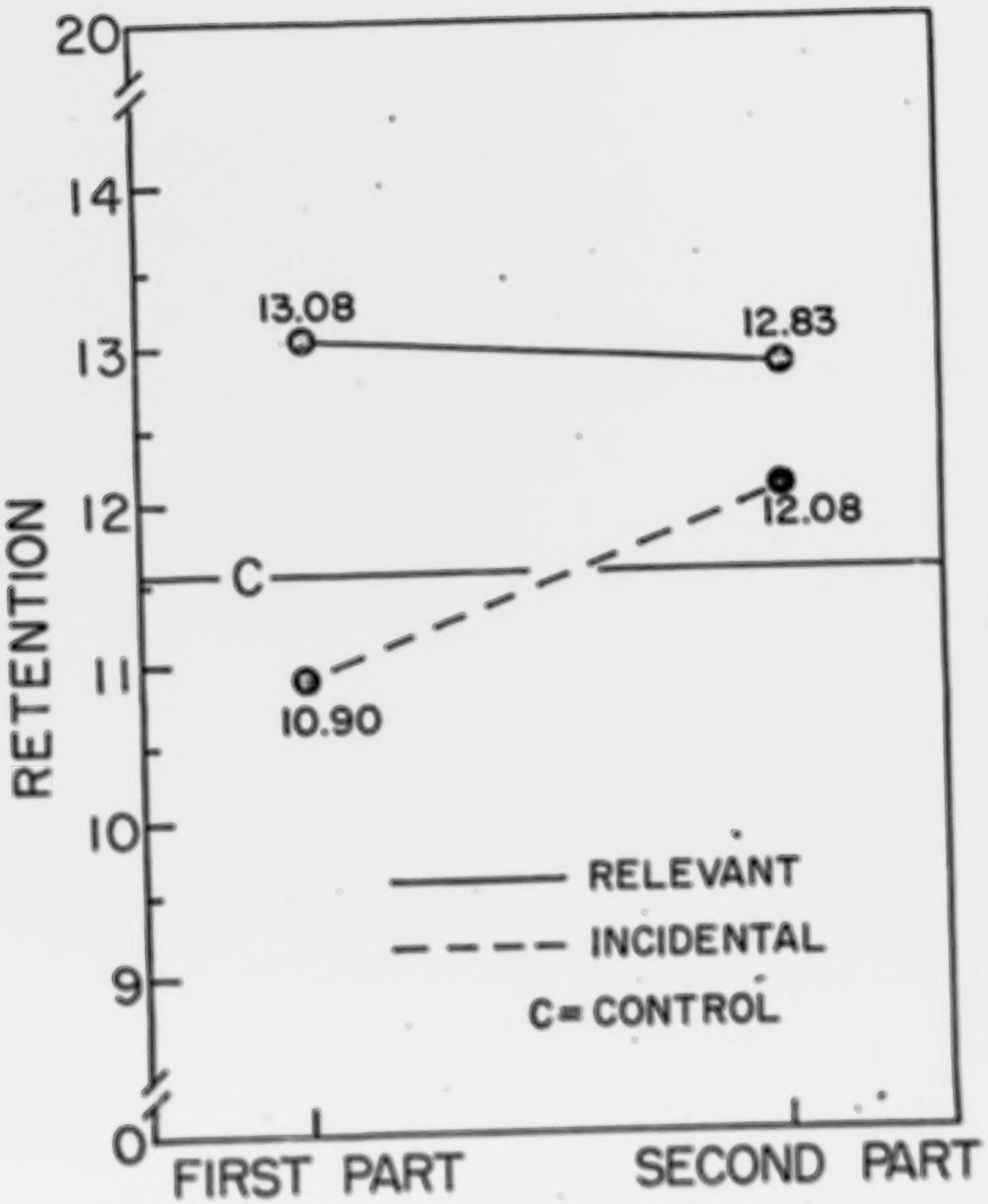

Fig. 3. Retention as a function of retention item and position of content within each 10 sentence paragraph. Converage of all conditions.